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(54) SWELLING DEBRIS BARRIER AND METHODS

SCHWELLFÄHIGE SCHUTTSPERRE UND VERFAHREN

BARRIÈRE DE DÉBRIS DE GONFLEMENT ET PROCÉDÉS ASSOCIÉS

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US-A- 6 019 173 US-A- 6 092 601
US-A- 6 092 601 US-A- 6 125 937
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Description

BACKGROUND

[0001] The present invention relates to equipment utilized and operations performed in conjunction with a subterranean well and, more particularly, to systems and methods for protecting the lower main wellbore of whipstocks and completion deflectors from debris accumulation.

[0002] Hydrocarbons can be produced through relatively complex wellbores traversing a subterranean formation. Some wellbores can include multilateral wellbores and/or sidetrack wellbores. Multilateral wellbores include one or more lateral wellbores extending from a parent (or main) wellbore. A sidetrack wellbore is a wellbore that is diverted from a first general direction to a second general direction and can include a main wellbore in the first general direction and a secondary wellbore diverted from the main wellbore in the second general direction. A multilateral wellbore can include one or more windows or casing exits to allow corresponding lateral wellbores to be formed. A sidetrack wellbore can also include a window or casing exit to allow the wellbore to be diverted to the second general direction.

[0003] The casing exit for either multilateral or sidetrack wellbores can be formed by positioning a casing joint and a whipstock in a casing string at a desired location in the main wellbore. The whipstock is used to deflect one or more mills laterally (or in an alternative orientation) relative to the casing string. The deflected mill(s) penetrates part of the casing joint to form the casing exit in the casing string. Drill bits can be subsequently inserted through the casing exit in order to cut the lateral or secondary wellbore.

[0004] During lateral drilling operations, it is desirable to protect lower portions of the main wellbore from the accumulation of debris that results from drilling. Such debris can plug the main wellbore and prevent follow on operations such as retrieving whipstocks or deflectors or the opening of fluid loss devices. One way of preventing debris is through the use of mechanical barriers, such as flapper valves, plugs, disks, etc. With the accumulation of a large amount of debris, however, it may be difficult to subsequently open the flapper valve for follow on operations or retrieve the plug or disk from the main wellbore. Another way of preventing debris buildup in the main wellbore is by protecting the area in question with one or more viscous fluids. Formulating the appropriate viscosity or mixture of the viscous fluid for each wellbore application, however, can oftentimes be difficult and as a result large amounts of drilling debris will nonetheless continue to pass through the viscous fluid.

[0005] GB 2 397 835 A relates to multilateral well construction and sand control completion.

[0006] US 6 019 173 A concerns a multilateral whipstock and tools for installing and retrieving.

[0007] US 6 092 601 A relates to an apparatus for com-

pleting a subterranean well and associated method of using the same.

[0008] US 6 125 937 A relates to methods of completing a subterranean well and associated apparatus.

SUMMARY OF THE INVENTION

[0009] The present invention relates to equipment utilized and operations performed in conjunction with a subterranean well and, more particularly, to systems and methods for protecting the lower main wellbore of whipstocks and completion deflectors from debris accumulation.

[0010] In some embodiments, a well system subassembly is disclosed. The subassembly may include a deflector tool arranged within a casing string and defining a deflector surface and an inner bore extending longitudinally from the deflector surface. The subassembly may also include one or more seal stacks disposed about the inner bore of the deflector tool, and a wellbore barrier device disposed about the inner bore and arranged uphole from the one or more seal stacks and being expandable from an unswelled configuration to a swelled configuration. When the wellbore barrier device is in the swelled configuration, the wellbore barrier device may be configured to protect the one or more seal stacks from debris generated from milling and/or drilling operations.

[0011] In some embodiments, a method of installing a wellbore system subassembly in a well is disclosed. The method may include arranging a deflector tool having an inner bore within a casing string cemented into the well. The deflector tool may have one or more seal stacks and a wellbore barrier device disposed about the inner bore. The wellbore barrier device may be arranged uphole from the one or more seal stacks. The method may also include expanding the wellbore barrier device inwardly from an unswelled configuration to a swelled configuration, and protecting with the swelled wellbore barrier device the one or more seal stacks from debris. The method may further include advancing a tubular string into the casing string. The tubular string may be separated into at least a first production tubular and a second production tubular. The method may also include penetrating the swelled wellbore barrier device with the first tubular string.

[0012] In some embodiments, another well system subassembly is disclosed. The subassembly may include a combination whipstock/deflector defining a deflector surface and an inner bore extending longitudinally from the deflector surface, and one or more seal stacks disposed about the inner bore of the combination whipstock/deflector. The subassembly may further include a swellable elastomer disposed about the inner bore and arranged above the one or more seal stacks. The swellable elastomer may be expandable from an unswelled configuration to a swelled configuration. When the swellable elastomer is in the swelled configuration, the swellable elastomer may be configured to protect the one

or more seal stacks from debris accumulation.

[0013] The features and advantages of the present invention will be readily apparent to those skilled in the art upon a reading of the description of the preferred embodiments that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The following figures are included to illustrate certain aspects of the present invention, and should not be viewed as exclusive embodiments. The subject matter disclosed is capable of considerable modification, alteration, and equivalents in form and function, as will occur to those skilled in the art and having the benefit of this disclosure.

FIG. 1 illustrates an exemplary well system subassembly as used in conjunction with, for example, an offshore oil and gas platform, according to one or more embodiments.

FIG. 2 illustrates an enlarged view of the well system subassembly of FIG. 1.

FIGS 3a and 3b illustrate an exemplary swellable elastomer in its unswelled and swelled configurations, respectively, according to one or more embodiments disclosed.

FIG. 4 illustrates another enlarged view of the well system subassembly of FIG. 1 as used in conjunction with a production tubular string, according to one or more embodiments.

FIG. 5 illustrates another enlarged view of the well system subassembly of FIG. 1 as used in conjunction with a production tubular string, according to one or more embodiments.

DETAILED DESCRIPTION

[0015] The present invention relates to equipment utilized and operations performed in conjunction with a subterranean well and, more particularly, to systems and methods for protecting the lower main wellbore of whipstocks and completion deflectors from debris accumulation.

[0016] The present invention provides a wellbore barrier used to protect seals and the lower portion of the main wellbore from debris that may accumulate during lateral wellbore drilling operations. In some embodiments, the wellbore barrier may be a swellable elastomer arranged on the inner diameter of an inner bore defined in a deflector tool, such as a whipstock, completion tool, or combination whipstock/completion tool. In its expanded configuration, the swellable elastomer protects a seal stack arranged in the inner bore of the deflector tool from damage caused by debris, which damage could compromise subsequent hydrocarbon production and/or allow the influx of sand. Moreover, the swollen swellable elastomer may provide a barrier around seal strings or other wellbore assemblies pushed through it. Lastly, while oth-

er wellbore barriers are configured for one time usage, the exemplary wellbore barriers disclosed herein may be used multiple times.

[0017] Referring to FIG. 1, illustrated is an exemplary well system subassembly 102 as used in conjunction with, for example, an offshore oil and gas platform 101, according to one or more embodiments of the disclosure. Even though FIG. 1 depicts an offshore oil and gas platform 101, it will be appreciated by those skilled in the art that the well system subassembly 102, and its alternative embodiments disclosed herein, are equally well suited for use in or on other types of oil and gas rigs, such as land-based oil and gas rigs or rigs established at any other geographic location. The platform 101 may be a semi-submersible platform centered over a submerged oil and gas formation 104 located below the sea floor 106. A subsea conduit 108 extends from the deck 110 of the platform 101 to a wellhead installation 112 including one or more blowout preventers 114. The platform 101 has a hoisting apparatus 116 and a derrick 118 for raising and lowering pipe strings, such as a drill string 120.

[0018] As depicted, a main wellbore 122 has been drilled through the various earth strata, including the formation 104. The terms "parent" and "main" wellbore are used herein to designate a wellbore from which another wellbore is drilled. It is to be noted, however, that a parent or main wellbore does not necessarily extend directly to the earth's surface, but could instead be a branch of yet another wellbore. A casing string 124 is at least partially cemented within the main wellbore 122. The term "casing" is used herein to designate a tubular string used to line a wellbore. Casing may actually be of the type known to those skilled in the art as "liner" and may be made of any material, such as steel or composite material and may be segmented or continuous, such as coiled tubing.

[0019] The well system subassembly 102 may be installed in or otherwise form part of the casing string 124. In one or more embodiments, the subassembly 102 may include a casing joint 126 interconnected between elongate portions or lengths of the casing string 124. In other embodiments, however, the casing joint 126 may be omitted and the subassembly 102 may be arranged within a portion of the casing string 124. The well system subassembly 102 may further include a deflector tool 130 positioned within the casing string 124 and/or the casing joint 126. The deflector tool 130 has a deflector surface that may be circumferentially oriented relative to the casing joint 126 such that a casing exit 132 can be milled, drilled, or otherwise formed in the casing joint 126 (or casing string 124, where applicable) in a desired circumferential direction.

[0020] As illustrated, the casing joint 126 is positioned at a desired intersection between the main wellbore 122 and a branch or lateral wellbore 134. In some embodiments, the deflector surface in the deflector tool 130 may further be used to direct production tubing into the lateral wellbore 134 for producing fluids, such as hydrocarbon fluids, oil, gas, water, steam, etc. The terms "branch" and

"lateral" wellbore are used herein to designate a wellbore which is drilled outwardly from its intersection with another wellbore, such as a parent or main wellbore. Moreover, a branch or lateral wellbore may have another branch or lateral wellbore drilled outwardly therefrom.

[0021] It will be appreciated by those skilled in the art that even though FIG. 1 depicts a vertical section of the main wellbore 122, the present disclosure is equally applicable for use in wellbores having other directional configurations including horizontal wellbores, deviated wellbores, slanted wellbores, combinations thereof, and the like. Moreover, use of directional terms such as above, below, upper, lower, upward, downward, uphole, downhole, and the like are used in relation to the illustrative embodiments as they are depicted in the figures, the upward direction being toward the top of the corresponding figure and the downward direction being toward the bottom of the corresponding figure, the uphole direction being toward the surface of the well and the downhole direction being toward the toe or bottom of the well.

[0022] Referring now to FIG. 2, illustrated is an enlarged view of the exemplary well system subassembly 102, according to one or more embodiments. The deflector tool 130 may be secured in the casing joint 126 and/or the casing string 124 using a packer, latch coupling, or other type of wellbore anchoring device 202. In some embodiments, the deflector tool 130 may be a whipstock device used for deflecting a cutting tool (e.g., one or more mills) into the casing joint 126 (or casing string 124, when applicable) to mill the casing exit 132 and initiate the lateral wellbore 134. In other embodiments, the deflector tool 130 may be a completion deflector tool run into the main wellbore 122 and set at the appropriate position for deflecting a completion tool into the casing exit 132. In yet other embodiments, the deflector tool 130 may be a combination whipstock/deflector capable of performing both the operations of a whipstock device and a completion deflector tool in a single run into the main wellbore 122.

[0023] The deflector tool 130 may define a deflector surface 204 operable to direct a milling tool into the sidewall of the casing joint 126 (or casing string 124, when applicable) to create the casing exit 132. The deflector surface 204 may further be operable to direct a drilling tool through the casing exit 132 to drill and/or extend the lateral wellbore 134. As illustrated, the deflector tool 130 may define an inner bore 206 extending longitudinally from the deflector surface 204 to the downhole end of the deflector tool 130.

[0024] In some embodiments, a tail pipe 208 may extend downhole from the deflector tool 130 and be engaged with a portion of completed production tubular 210 that extends further down into the main wellbore 122. As illustrated, the completed production tubular 210 may be coupled to the casing string 124 with one or more packers 212 or other tubular stabilizing devices known in the art. The tail pipe 208 may further include one or more completion seals 214 disposed about its outer circumference

and configured to seal against the inner surface of the completed production tubular 210. Accordingly, as the deflector tool 130 is being set, the tail pipe 208 may be "strung" into the production tubular 210 and the completion seals 214 may be configured to provide a sealed connection between the tail pipe 208 and the lower production tubular 210. In other embodiments, the one or more completion seals 214 may be disposed about the inner surface of the completed production tubular 210 and serve the same purpose, without departing from the scope of the disclosure. In yet other embodiments, the production tubular 210 may be sealingly secured directly to the anchoring device 202 and/or deflector tool 130, thereby providing a sealed connection between the deflector tool 130 and the production tubular 210.

[0025] The well system subassembly 102 may further include one or more seal stacks 216 and a wellbore barrier device 218. The one or more seal stacks 216 may be disposed about the inner surface of the inner bore 206 (e.g., disposed about the inner diameter of the inner bore 206). As will be described in more detail below, the seal stack 216 may be configured to receive and seal a production tubular extended from the surface. The wellbore barrier device 218 may also be disposed about the inner surface of the inner bore 206 of the deflector tool 130. In operation, the wellbore barrier device 218 may be configured to protect the seal stack 216 and the lower portions of the main wellbore 122 from damage caused by milling/drilling debris 220. Debris 220 may damage the seal stack 216 and result in underperforming hydrocarbon production or the production of sand through the seal stack 216. Accumulated debris 220 may also plug the inner bore 206 or lower bores (e.g., the completed production tubular 210), thereby preventing follow on operations, such as retrieving whipstocks or deflectors.

[0026] In one or more embodiments, the wellbore barrier device 218 may be a swellable elastomer configured to swell or expand inwardly from the inner diameter of the inner bore. The swellable elastomer may be made of any known swelling elastomeric material. In other embodiments, however, the wellbore barrier device 218 may be a swell packer, as known by those skilled in the art, and configured to expand or swell in response to a predetermined wellbore pressure, temperature, mechanical/hydraulic/electronic actuation mechanism, etc.

[0027] As illustrated in FIG. 2, the wellbore barrier device 218 is shown as a swellable elastomer configured to swell from an unswelled state or configuration, to a swelled state or configuration (as shown by the dashed lines). Once in position in the main wellbore 122, the swelling could take place through exposure to the ambient wellbore fluids or by spotting an appropriate catalyst fluid through the running string. For example, the swellable elastomer may be configured to react with various downhole media such as, but not limited to, water, hydrocarbons, wellbore chemicals, combinations thereof, or the like.

[0028] Referring now to FIGS. 3a and 3b, illustrated is

the exemplary wellbore barrier device 218 in its unswelled and swelled configurations, respectively. As the deflector tool 130 is run into the main wellbore 122 (FIGS. 1 and 2), the wellbore barrier device 218 may be in its unswelled configuration. Having the wellbore barrier device 218 in the unswelled configuration may prove advantageous since it may allow for fluid by-pass through the wellbore barrier device 218 as the deflector tool 130 is run. Since the wellbore 122 will likely be filled with fluid(s), once the tail pipe 208 has engaged the seals 214, if there were no fluid by-pass through the wellbore barrier device 218, an incompressible hydraulic lock could result, thereby preventing further advancement of the deflector tool 130 or wellbore barrier device 218. As a result, the deflector tool 130 would not be capable of advancing all the way to depth. Conversely, if the deflector tool 130 needs to be retrieved and the wellbore barrier device 218 is swelled and the seals 214 are properly engaged with the tail pipe, it may be difficult to retract the tail pipe 208 out of the seals 214 (i.e., suction pressures within the completed production tubular 210 would prevent this from occurring).

[0029] Once the deflector tool 130 is lowered to and set at its predetermined depth in the main wellbore 122, however, the wellbore barrier device 218 may be configured to initiate swelling to its swelled configuration. In some embodiments, the swelled configuration creates a pressure tight seal in the inner bore 206, thereby effectively isolating the portions above and below the wellbore barrier device 218. In other embodiments, however, the wellbore barrier device 218 does not necessarily provide a fluid tight seal in its swelled configuration. Instead, the wellbore barrier device 218 may be configured to swell radially inward to generally fill the axial portion of the inner bore 206 covered by the wellbore barrier device. As a result, the wellbore barrier device 218 serves as a physical barrier from debris 220 (FIG. 2) generated through milling the casing exit 132 and/or drilling of the lateral wellbore 134 (FIGS. 1 and 2).

[0030] Referring now to FIG. 4, illustrated is the well system subassembly 102 after the lateral wellbore 134 has been drilled and the wellbore barrier device 218 has assumed its swelled configuration, according to one or more embodiments. After the necessary operations are performed in the lateral wellbore 134, a tubular string 402 may be extended down into the main wellbore 122 in an effort to complete the well and initiate hydrocarbon production. As illustrated, a completion tool 404 may be coupled to the tubular string 402 and also run into the main wellbore 122. The completion tool 404 may eventually be set at or near the casing exit 132, thereby establishing a lateral junction 406. In one or more embodiments, the completion tool 404 may be a screen or some other contrivance configured to prevent undesired entrance of solids and/or fluids from a formation proximate the casing exit 132 into either the main wellbore 122 or the lateral wellbore 134. The junction 406 may be in conformance with one of the levels defined by the technology advance-

ment for multilaterals (TAML) organization, for example a TAML Level 5 multilateral junction.

[0031] The completion tool 404 may separate the tubular string 402 into at least a first production tubular 408 and a second production tubular 410. The first production tubular 408 may be configured to extend further into the main wellbore 122, and the second production tubular 410 may be configured to extend into the lateral wellbore 134. In order to sealingly couple or engage the tubular string 402 to the completed tubular string 210 downhole, the first production tubular 408 may be configured to penetrate the swollen wellbore barrier device 218 and subsequently "sting" into the seal stack 216 as the tubular string 402 advances downhole.

[0032] Prior to penetrating the swollen wellbore barrier device 218, however, the accumulated debris 220 may be required to be removed or otherwise washed off of the swollen wellbore barrier device 218. In some embodiments, the debris 220 may be removed or washed away through the circulation and injection a fluid through the first production tubular 408. In other embodiments, the debris 220 may be washed away through the injection and circulation of a fluid through any string or tubular that enters the main wellbore 122 after the wellbore barrier device 218 has assumed its swelled configuration. In yet other embodiments, the debris 220 may be removed through suction means, such as by using a downhole vacuum tool or removing the debris 220 by physically "bailing" the debris 220 out.

[0033] Referring now to FIG. 5, once the debris 220 (FIG. 4) is adequately removed from the swelled wellbore barrier device 218, the first production tubular 408 may then be advanced into the inner bore 206 until contacting the swelled wellbore barrier device 218. With sufficient set-down force applied to the tubular string 402, the first production tubular 408 may penetrate and be pushed through the swollen wellbore barrier device 218. Advancing the tubular string 402 further downhole may eventually "sting" the first production tubular 408 into the seal stack 216 and thereby place the tubular string 402 in sealed communication with the completed production tubular 210 therebelow.

[0034] During production operations in the formation 104 (FIG. 1), the penetrated wellbore barrier device 218 may sealingly engage the outer diameter of the first production tubular 408 and thereby continue to provide a debris barrier around the first production tubular 408. In one or more embodiments, in the event the tubular string 402 and accompanying first and second production tubulars 408, 410 are removed from the main wellbore 122, the wellbore barrier device 218 may be configured to return to its swelled configuration and continue to provide a debris barrier for the seal stack 216 and lower bore elements and components.

[0035] A method of installing the wellbore system subassembly 102 in a well is also disclosed herein. The method includes arranging a deflector tool having an inner bore within a casing string cemented into the well.

The deflector tool may have one or more seal stacks and a wellbore barrier device disposed about the inner bore. The wellbore barrier device is arranged uphole from the one or more seal stacks. The method further includes expanding the wellbore barrier device inwardly from an unswelled configuration to a swelled configuration, and protecting with the swelled wellbore barrier device the one or more seal stacks from debris. The method may also include advancing a tubular string into the casing string, where the tubular string is separated into at least a first production tubular and a second production tubular, and penetrating the swelled wellbore barrier device with the first tubular string.

[0036] The method may further include advancing the deflector tool within the casing string while the wellbore barrier device is in the unswelled configuration. In some embodiments, prior to penetrating the swelled wellbore barrier device the method further includes removing accumulated debris from the swelled wellbore barrier device. In some embodiments, removing the accumulated debris from the swelled wellbore barrier device includes injecting a fluid through the first production tubular, and washing the debris away from the swelled wellbore barrier. In some embodiments, expanding the wellbore barrier device inwardly includes exposing the wellbore barrier device to downhole media. In other embodiments, expanding the wellbore barrier device inwardly includes exposing the wellbore barrier device to a catalyst fluid injected into the well. In some embodiments, the method further includes removing the first production tubular from the wellbore barrier device, and allowing the wellbore barrier device to expand back into the swelled configuration.

[0037] Therefore, the present invention is well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the present invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered, combined, or modified and all such variations are considered within the scope of the present invention. The invention illustratively disclosed herein suitably may be practiced in the absence of any element that is not specifically disclosed herein and/or any optional element disclosed herein. While compositions and methods are described in terms of "comprising," "containing," or "including" various components or steps, the compositions and methods can also "consist essentially of" or "consist of" the various components and steps. All numbers and ranges disclosed above may vary by some amount. Whenever a numerical range with a lower limit and an upper limit is disclosed, any number and any included range falling within the range is specifically disclosed. In

particular, every range of values (of the form, "from about a to about b," or, equivalently, "from approximately a to b," or, equivalently, "from approximately a-b") disclosed herein is to be understood to set forth every number and range encompassed within the broader range of values. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee. Moreover, the indefinite articles "a" or "an," as used in the claims, are defined herein to mean one or more than one of the element that it introduces. If there is any conflict in the usages of a word or term in this specification and one or more patent or other documents that may be incorporated herein by reference, the definitions that are consistent with this specification should be adopted.

Claims

1. A well system subassembly (102), comprising:
 - a deflector tool (130) arranged within a casing string (124) and defining a deflector surface (204) and an inner bore (206) extending longitudinally from the deflector surface (204);
 - one or more seal stacks (216) disposed about the inner bore (206) of the deflector tool (130);
 - and **characterised by**
 - a wellbore barrier device (218) disposed about the inner bore (206) and arranged uphole from the one or more seal stacks (216) and being expandable from an unswelled configuration to a swelled configuration, wherein when the wellbore barrier device (218) is in the swelled configuration, the wellbore barrier device (218) protects the one or more seal stacks (216) from debris generated from milling and/or drilling operations.
2. A subassembly as claimed in claim 1, wherein the deflector tool is a whipstock device or a combination whipstock/deflector tool.
3. A subassembly as claimed in claim 1, further comprising a tail pipe coupled to and extending downhole from the deflector tool.
4. A subassembly as claimed in claim 1, wherein the wellbore barrier device is a swellable elastomer, preferably wherein the swellable elastomer swells to the swelled configuration by being exposed to a downhole media or by spotting an appropriate catalyst fluid through a running string run into the casing string.
5. A subassembly as claimed in claim 1, wherein the wellbore barrier device is a well packer.

6. A subassembly as claimed in claim 1, wherein the swelled configuration creates a pressure tight seal in the inner bore.

7. A method of installing a wellbore system subassembly (102) in a well, comprising:

arranging a deflector tool (130) having an inner bore (206) within a casing string (124) cemented into the well, the deflector tool (130) having one or more seal stacks (216) and **characterised by** a wellbore barrier device (218) disposed about the inner bore (206), wherein the wellbore barrier device (218) is arranged uphole from the one or more seal stacks (216);
expanding the wellbore barrier device (218) inwardly from an unswelled configuration to a swelled configuration;
protecting with the swelled wellbore barrier device (218) the one or more seal stacks (216) from debris;
advancing a tubular string (402) into the casing string (124), the tubular string (402) being separated into at least a first production tubular (408) and a second production tubular (410); and
penetrating the swelled wellbore barrier device with the first tubular string (402).

8. A method as claimed in claim 7, further comprising advancing the deflector tool within the casing string while the wellbore barrier device is in the unswelled configuration.

9. A method as claimed in claim 7, further comprising advancing the second production tubular into a lateral wellbore.

10. A method as claimed in claim 7, wherein prior to penetrating the swelled wellbore barrier device the method further comprises removing accumulated debris from the swelled wellbore barrier device, preferably wherein removing the accumulated debris from the swelled wellbore barrier device comprises:

injecting a fluid through the first production tubular; and
washing the debris away from the swelled wellbore barrier.

11. A method as claimed in claim 7, wherein expanding the wellbore barrier device inwardly comprises exposing the wellbore barrier device to downhole media or to a catalyst fluid injected into the well.

12. A method as claimed in claim 7, further comprising:

removing the first production tubular from the

wellbore barrier device; and
allowing the wellbore barrier device to expand back into the swelled configuration.

13. A well system subassembly as claimed in claim 1, wherein the deflector tool is a combination whipstock/deflector, and the wellbore barrier device is a swellable elastomer arranged above the one or more seal stacks.

14. A subassembly as claimed in claim 13, wherein the swellable elastomer swells to the swelled configuration by being exposed to downhole media.

15. A subassembly as claimed in claim 13, wherein the swellable elastomer is able to be penetrated by a production tubular.

20 Patentansprüche

1. Bohrlochsystemunterbaugruppe (102), umfassend:

ein Ablenkungswerkzeug (130), das in einem Futterrohrstrang (124) angeordnet ist und eine Ablenkfläche (204) und eine Innenbohrung (206) definiert, die sich in Längsrichtung von der Ablenkfläche (204) erstreckt;
einen oder mehrere Dichtungsstapel (216), die um die Innenbohrung (206) des Ablenkungswerkzeugs (130) herum angeordnet sind; und
gekennzeichnet durch:

eine Bohrlochsperrvorrichtung (218), die um die Innenbohrung (206) herum angeordnet und weiter oben im Bohrloch als der eine oder die mehreren Dichtungsstapel (216) angeordnet ist und aus einer nicht aufgequollenen Konfiguration in eine aufgequollene Konfiguration erweiterbar ist, wobei, wenn die Bohrlochsperrvorrichtung (218) in der aufgequollenen Konfiguration ist, die Bohrlochsperrvorrichtung (218) den einen oder die mehreren Dichtungsstapel (216) vor Trümmern schützt, die bei Fräs- und/oder Bohrvorgängen erzeugt werden.

2. Unterbaugruppe nach Anspruch 1, wobei das Ablenkungswerkzeug ein Ablenkkeilvorrichtung oder eine Kombination aus Ablenkkeil/ Ablenkungswerkzeug ist.

3. Unterbaugruppe nach Anspruch 1, ferner umfassend ein Endrohr, das an das Ablenkungswerkzeug gekoppelt ist und sich von diesem ins Bohrloch herab erstreckt.

4. Unterbaugruppe nach Anspruch 1, wobei die Bohr-

- lochsperrvorrichtung ein quellfähiges Elastomer ist, wobei das quellfähige Elastomer vorzugsweise in die aufgequollene Konfiguration aufquillt, indem es einem Bohrlochmedium ausgesetzt wird oder indem ein geeignetes Katalysatorfluid durch einen Laufstrang, der in den Futterrohrstrang eingelassen wird, aufgespritzt wird.
5. Unterbaugruppe nach Anspruch 1, wobei die Bohrlochsperrvorrichtung ein Bohrlochpacker ist.
6. Unterbaugruppe nach Anspruch 1, wobei die aufgequollene Konfiguration eine druckdichte Dichtung in der Innenbohrung erzeugt.
7. Verfahren zum Installieren einer Bohrlochsystemunterbaugruppe (102) in einem Bohrloch, umfassend:
- Anordnen eines Ablenkungswerkzeugs (130) mit einer Innenbohrung (206) in einem Futterrohrstrang (124), der in das Bohrloch zementiert ist, wobei das Ablenkungswerkzeug (130) einen oder mehrere Dichtungsstapel (216) aufweist, und **gekennzeichnet durch** eine Bohrlochsperrvorrichtung (218), die um die Innenbohrung (206) herum angeordnet wird, wobei die Bohrlochsperrvorrichtung (218) weiter oben als der eine oder die mehreren Dichtungsstapel (216) im Bohrloch angeordnet wird;
- Erweitern der Bohrlochsperrvorrichtung (218) nach innen aus einer nicht aufgequollenen Konfiguration in eine aufgequollene Konfiguration;
- Schützen des einen oder der mehreren Dichtungsstapel (216) mit der aufgequollenen Bohrlochsperrvorrichtung (218) vor Trümmern;
- Vorschieben eines Rohrstrangs (402) in den Futterrohrstrang (124), wobei der Rohrstrang (402) in wenigstens ein erstes Förderrohr (408) und ein zweites Förderrohr (410) unterteilt ist; und
- Durchdringen der aufgequollenen Bohrlochsperrvorrichtung mit dem ersten Rohrstrang (402).
8. Verfahren nach Anspruch 7, ferner umfassend Vorschieben des Ablenkungswerkzeugs in dem Futterrohrstrang, während die Bohrlochsperrvorrichtung in der nicht aufgequollenen Konfiguration ist.
9. Verfahren nach Anspruch 7, ferner umfassend Vorschieben des zweiten Förderrohrs in ein seitliches Bohrloch.
10. Verfahren nach Anspruch 7, wobei das Verfahren vor dem Durchdringen der aufgequollenen Bohrlochsperrvorrichtung das Entfernen von angesammelten Trümmern aus der aufgequollenen Bohrlochsperrvorrichtung umfasst, wobei das Entfernen der angesammelten Trümmer aus der aufgequollenen Bohrlochsperrvorrichtung vorzugsweise Folgendes umfasst:
- Einspritzen eines Fluids durch das erste Förderrohr; und
- Auswaschen der Trümmer aus der aufgequollenen Bohrlochsperrvorrichtung.
11. Verfahren nach Anspruch 7, wobei das Erweitern der Bohrlochsperrvorrichtung nach innen das Aussetzen der Bohrlochsperrvorrichtung einem Bohrlochmedium oder einem Katalysatorfluid umfasst, das in das Bohrloch eingespritzt wird.
12. Verfahren nach Anspruch 7, ferner umfassend:
- Entfernen des ersten Förderrohrs aus der Bohrlochsperrvorrichtung; und
- Zulassen, dass sich die Bohrlochsperrvorrichtung zurück in die aufgequollene Konfiguration erweitert.
13. Bohrlochsystemunterbaugruppe nach Anspruch 1, wobei das Ablenkungswerkzeug eine Kombination aus Ablenkkeil/Ablenker ist und die Bohrlochsperrvorrichtung ein quellfähiges Elastomer ist, das über dem einen oder den mehreren Dichtungsstapeln angeordnet ist.
14. Bohrlochsystemunterbaugruppe nach Anspruch 13, wobei das quellfähige Elastomer in die aufgequollene Konfiguration aufquillt, indem es dem Bohrlochmedium ausgesetzt wird.
15. Bohrlochsystemunterbaugruppe nach Anspruch 13, wobei das quellfähige Elastomer von dem Förderrohr durchdrungen werden kann.

Revendications

1. Sous-ensemble de système de puits (102), comprenant :
- un outil de déviation (130) disposé à l'intérieur d'une colonne de tubage(124) et définissant une surface de déflecteur (204) et un alésage intérieur (206) s'étendant longitudinalement à partir de la surface de déflecteur (204) ;
- une ou plusieurs piles d'étanchéité (216) disposée (s) autour de l'alésage intérieur (206) de l'outil de déviation (130) ; et **caractérisé par**
- un dispositif de barrière de puits de forage (218) disposé autour de l'alésage intérieur (206) et agencé en amont du trou à partir de l'une ou de plusieurs piles d'étanchéité (216) et expansible

- d'une configuration non gonflée à une configuration gonflée, dans lequel quand le dispositif de barrière de puits de forage (218) est dans la configuration gonflée, le dispositif de barrière de puits de forage (218) protège l'une ou plusieurs des piles d'étanchéité (216) des débris générés à partir des opérations de fraisage et/ou de perçage.
2. Sous-ensemble selon la revendication 1, dans lequel l'outil de déviation est un dispositif à sifflets déviateurs ou une combinaison d'un outil à sifflets déviateurs/de déviation.
 3. Sous-ensemble selon la revendication 1, comprenant en outre un tuyau arrière couplé à l'outil de déviation et s'étendant dans le fond de trou à partir de celui-ci.
 4. Sous-ensemble selon la revendication 1, dans lequel le dispositif de barrière de puits de forage est un élastomère gonflable, de préférence dans lequel l'élastomère gonflable gonfle jusqu'à la configuration gonflée en étant exposé à un milieu de fond de trou ou en repérant un fluide de catalyseur approprié à travers un train de tiges mobiles passé dans la colonne de tubage.
 5. Sous-ensemble selon la revendication 1, dans lequel le dispositif de barrière de puits de forage est une garniture d'étanchéité de puits.
 6. Sous-ensemble selon la revendication 1, dans lequel la configuration gonflée crée un joint d'étanchéité à l'épreuve de la pression dans l'alésage intérieur.
 7. Procédé d'installation d'un sous-ensemble de système de puits de forage (102) dans un puits, comprenant :
 - l'agencement de l'outil de déviation (130) ayant un alésage intérieur (206) à l'intérieur d'une colonne de tubage(124) cimentée dans le puits, l'outil de déviation (130) ayant une ou plusieurs piles d'étanchéité (216) et **caractérisé par** un dispositif de barrière de puits de forage (218) disposé autour de l'alésage intérieur (206), dans lequel le dispositif de barrière de puits de forage (218) est disposé en amont du trou à partir de l'une ou de plusieurs piles d'étanchéité (216) ; la dilatation du dispositif de barrière de puits de forage (218) vers l'intérieur d'une configuration non gonflée à une configuration gonflée ; la protection des débris avec le dispositif de barrière de puits de forage (218) de l'une ou de plusieurs piles d'étanchéité (216) ; l'avancement d'une colonne tubulaire (402) dans la colonne de tubage (124), la colonne tubulaire(402) étant séparée au moins en un premier tubage de production (408) et en un second tubage de production(410) ; et la pénétration dans le dispositif de barrière de puits de forage gonflé avec la première colonne tubulaire(402).
 8. Procédé selon la revendication 7, comprenant en outre l'avancement de l'outil de déviation à l'intérieur de la colonne de tubage pendant que le dispositif de barrière de puits de forage est dans la configuration non gonflée.
 9. Procédé selon la revendication 7, comprenant en outre l'avancement du second tubage de production dans un puits de forage latéral.
 10. Procédé selon la revendication 7, dans lequel avant de pénétrer dans le dispositif de barrière de puits de forage gonflé, le procédé comprend en outre le retrait des débris cumulés du dispositif de barrière de puits de forage gonflé, de préférence dans lequel le retrait des débris cumulés du dispositif de barrière de puits de forage gonflé comprend :
 - l'injection d'un fluide à travers le premier tubage de production ; et
 - le nettoyage par lavage des débris de la barrière de puits de forage gonflée.
 11. Procédé selon la revendication 7, dans lequel la dilatation du dispositif de barrière de puits de forage vers l'intérieur comprend l'exposition du dispositif de barrière de puits de forage au milieu de fond de trou ou au fluide de catalyseur injecté dans le puits.
 12. Procédé selon la revendication 7, comprenant en outre :
 - le retrait du premier tubage de production du dispositif de barrière de puits de forage ; et
 - le fait de permettre au dispositif de barrière de puits de forage de se dilater à nouveau dans la configuration gonflée.
 13. Sous-ensemble de système de puits selon la revendication 1, dans lequel l'outil de déviation est une combinaison de sifflets déviateurs/défecteur, et dans lequel le dispositif de barrière de puits de forage est un élastomère gonflable disposé au-dessus de l'une ou de plusieurs piles d'étanchéité.
 14. Sous-ensemble selon la revendication 13, dans lequel l'élastomère gonflable gonfle dans la configuration gonflée en étant exposé à un milieu de fond de trou.
 15. Sous-ensemble selon la revendication 13, dans le-

quel l'élastomère gonflable peut être pénétré par un tubage de production.

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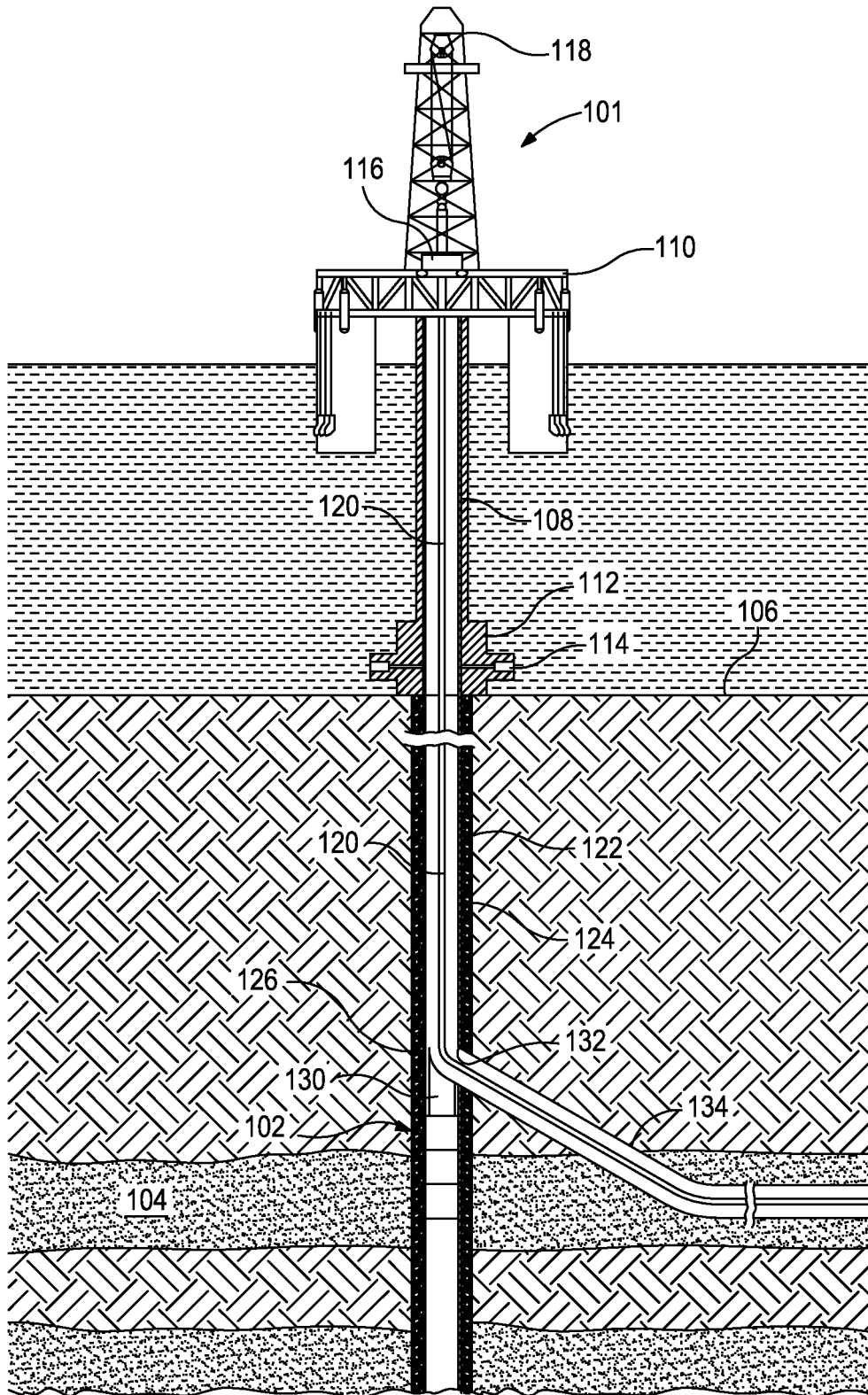


FIG. 1

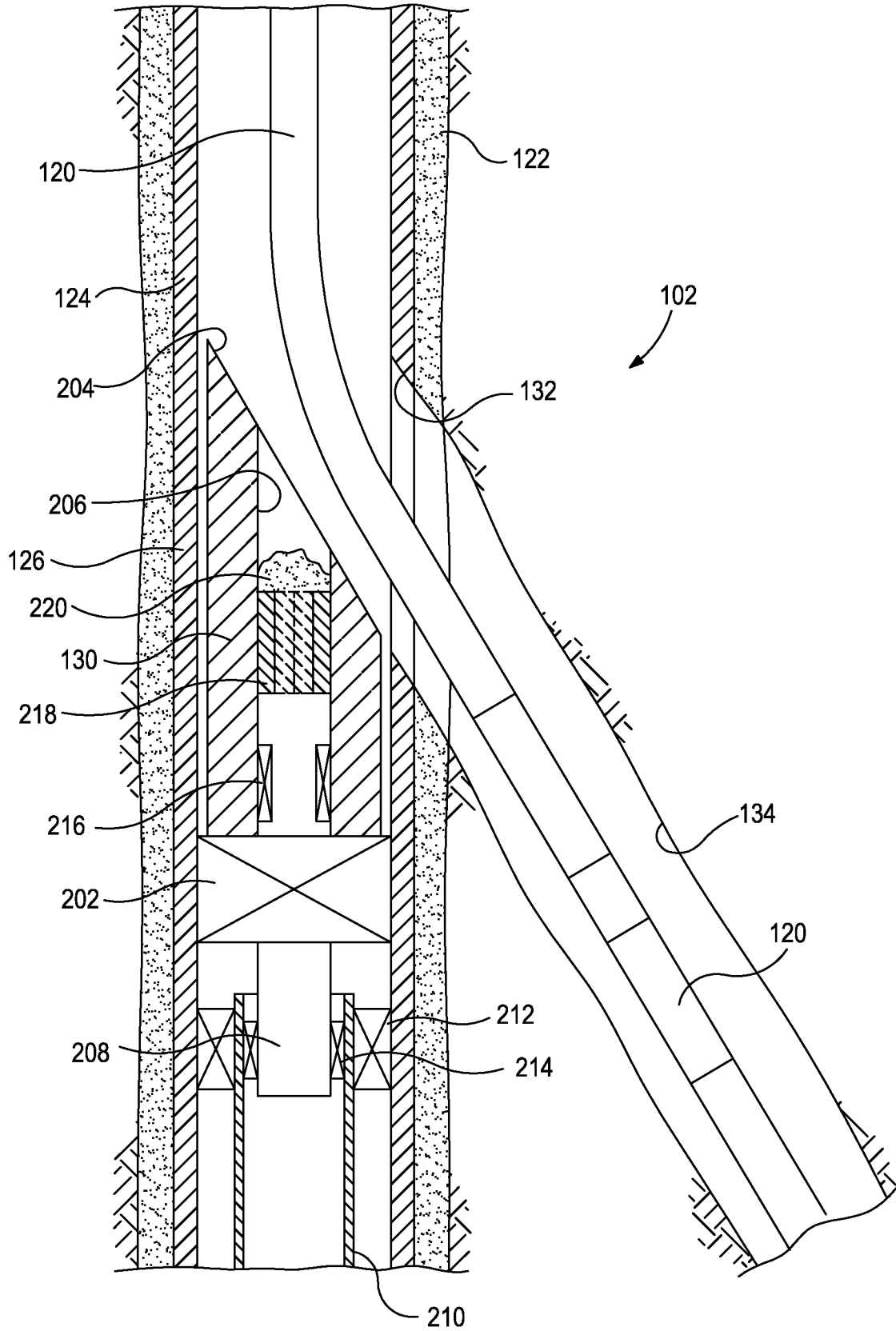


FIG. 2

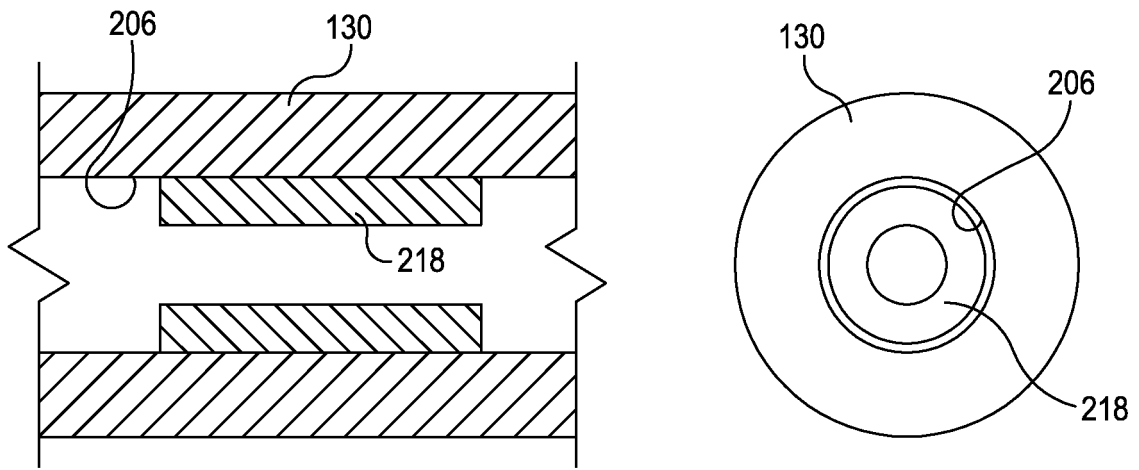


FIG. 3a

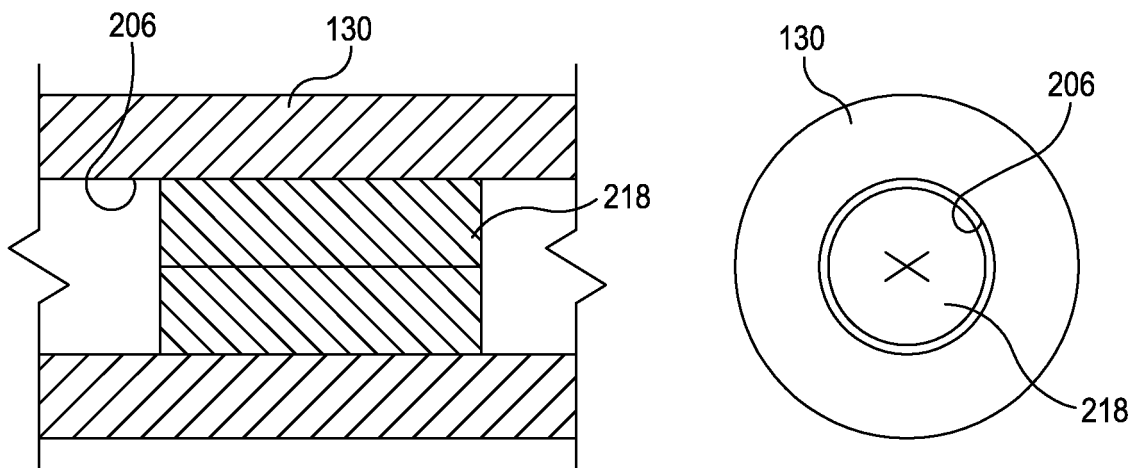


FIG. 3b

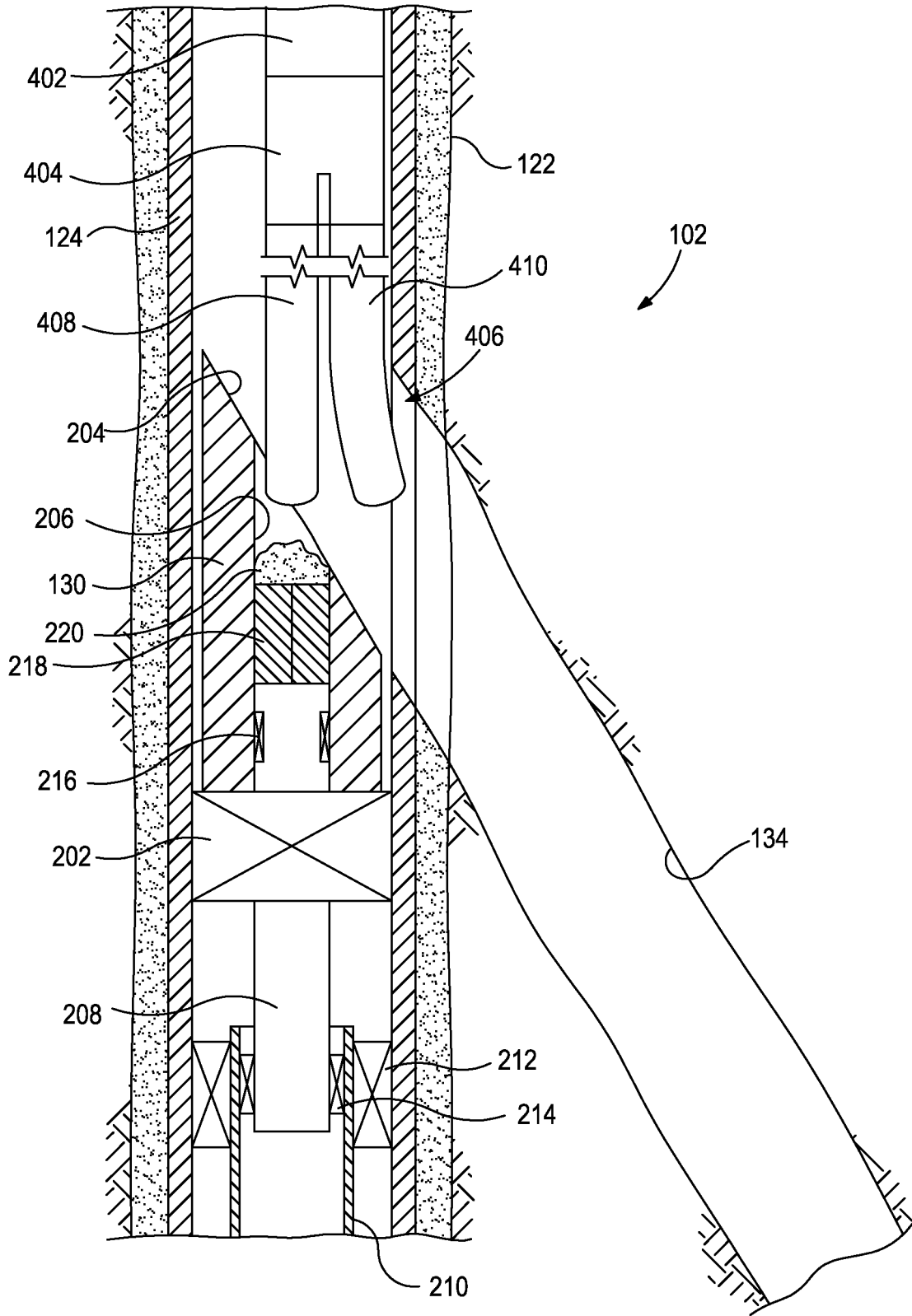


FIG. 4

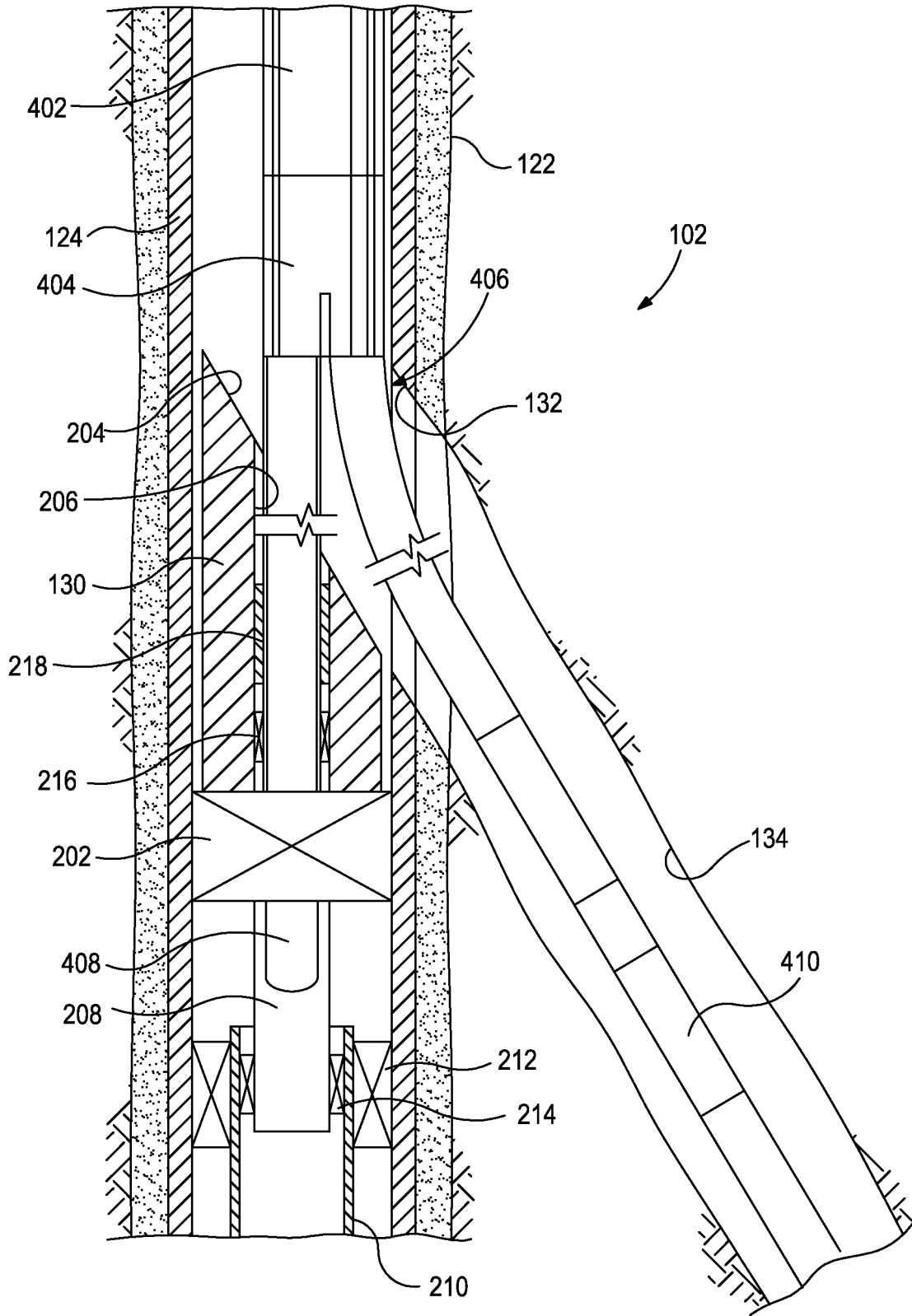


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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